

Patent Claims

1. An emergency cooling system for a component (1) which is subject to thermal load in operation, in particular a component of a turbine,
 - the component (1) having a wall (3) which, in operation, is acted on by heat on a first wall side (14) and is acted on by a flow of cooling fluid (11) on a second wall side (15),
 - the wall (3) having at least one emergency cooling opening (12) which is closed off by a plug (16) and through which cooling fluid (13) flows from the second wall side (15) to the first wall side (14) when the plug (16) is absent,
 - the plug (16) being designed in such a way that it melts at a predetermined temperature,characterized
 - in that the plug (16) is a body which is produced separately from the component (1),
 - in that the plug (16) is inserted into the emergency cooling opening (12), in which it is connected to the component (1).
2. The emergency cooling system as claimed in claim 1, characterized in that the plug (16) is soldered or welded into the associated emergency cooling opening (12).
3. The emergency cooling system as claimed in claim 1 or 2, characterized in that the plug (16) is connected to the component (1) in a positively locking manner in the associated emergency cooling opening (12).

4. The emergency cooling system as claimed in claim 3, characterized
- in that the plug (16) has a first positive locking contour (18),
 - 5 - in that the emergency cooling opening (12) has a second positive locking contour (19), which is of complementary design to the first positive locking contour (18),
 - in that the first positive locking contour (18) and
10 second positive locking contour (19) are designed in such a way that the plug (16) can be inserted into the emergency cooling opening (12) on the first wall side (14), which in operation is acted on by heat.
- 15 5. The emergency cooling system as claimed in claim 3 or 4, characterized
- in that the plug (16) has an external screw thread (18) and is screwed into the associated emergency cooling opening (12), which has an internal screw
20 thread (19) which is complementary with respect to the external screw thread (18), or
 - in that the plug (16) has first bayonet catch elements and is anchored in the associated emergency cooling opening (12), which has second bayonet catch elements,
25 which are complementary with respect to the first bayonet catch elements.
- 30 6. The emergency cooling system as claimed in one of claims 1 to 5, characterized in that the plug (16) is designed in such a way as to melt when it is exposed to the predetermined temperature or a higher temperature for a predetermined time.

7. The emergency cooling system as claimed in one of claims 1 to 6, characterized in that the melting point of the plug (16) is selected so as to be greater than the maximum temperature permissible for normal operation of the component (1) and lower than the melting point of the component (1).
8. The emergency cooling system as claimed in one of claims 1 to 7, characterized in that the plug (16) is designed so as to melt relatively quickly when its melting point is reached.
9. The emergency cooling system as claimed in one of claims 1 to 8, characterized
- in that the plug (16) has a plug body (20) having the predetermined melting point,
 - in that the plug body (20) has a protective layer (21) which is designed in such a way that it serves as a diffusion barrier between the material of the plug body (20) and the material of the wall (3) and/or that it protects the plug body (20) from oxidation and/or corrosion and/or erosion.
10. The emergency cooling system as claimed in one of claims 1 to 9, characterized
- in that the plug (16) or the plug body (20) consists of an Ni-based alloy which contains at least one of the following alloying constituents: Hf, Si, Zr, Cr, Al, Ti, Nb, B, Co,
 - in that to set a predetermined melting point (T_m) for the plug (16) or for the plug body (20), the percentages by weight of the individual alloying constituents are selected in such a way that the following equation substantially applies:

$$T_m = (1460 - 9.5 \times \text{Hf} - 30 \times \text{Si} - 170 \times \text{Zr} - 2.75 \times \text{Cr} - 9.4 \times \text{Al} - 10.6 \times \text{Ti} - 10.8 \times \text{Nb} - 208 \times \text{B} + 1 \times \text{Co})^\circ \text{C},$$

5 - the individual alloying constituents being introduced into the equation on the basis of their percentages by weight.

10 11. The emergency cooling system as claimed in one of claims 1 to 10, characterized in that the plug (16) or plug body (20) consists of one of the following Ni-based alloys:

 - Ni-Hf alloy containing from 25 to 30% by weight of Hf, remainder Ni,

15 - Ni-Si alloy containing from 7 to 12% by weight of Si, remainder Ni,

 - Ni-Hf-Si alloy containing from 20 to 30% by weight of Hf, from 5 to 12% by weight of Si, remainder Ni,

20 - Ni-Hf-Si-Cr-Al alloy containing from 10 to 30% by weight of Hf, from 5 to 12% by weight of Si, from 5 to 30% by weight of Cr, from 2 to 5% by weight of Al, remainder Ni,

25 - Ni-Hf-Cr-Al-Si-Co-Ti-Ta-Nb-Zr alloy containing from 5 to 20% by weight of Hf, from 5 to 30% by weight of Cr, from 2 to 5% by weight of Al, from 4 to 12% by weight of Si, from 0 to 25% by weight of Co, from 0 to 5% by weight of Ti, from 0 to 5% by weight of Ta, from 0 to 5% by weight of Nb, from 0.3 to 3% by weight of Zr, remainder Ni,

30 - Ni-Hf-Cr-Al-Si-Co-Ti-Ta-Nb-Zr-B alloy containing from 5 to 20% by weight of Hf, from 5 to 30% by weight of Cr, from 2 to 5% by weight of Al, from 4 to 12% by weight of Si, from 0 to 25% by weight of Co, from 0 to 5% by weight of Ti, from 0 to 5% by weight of Ta, from

0 to 5% by weight of Nb, from 0.3 to 3% by weight of Zr, from 0 to 2.5% by weight of B, remainder Ni.

12. The emergency cooling system at least as claimed in
5 claim 9, characterized
- in that the protective layer (21) consists of a thin Pt layer, or
 - in that the protective layer (21) consists of a Pt layer and an Al layer, or
 - 10 - in that the protective layer (21) consists of an Al layer or an Al alloy layer.
13. A plug for a component (1) which is subject to thermal load in operation, in particular a component of a turbine,
- 15 - the component (1) having a wall (3) which, in operation, is acted on by heat on a first wall side (14) and is acted on by a flow of cooling fluid (11) on a second wall side (15),
- the wall (3) having at least one emergency cooling
20 opening (12) which can be closed off by the plug (16) and through which cooling fluid (13) flows from the second wall side (15) to the first wall side (14) when the plug (16) is absent,
 - the plug (16) being designed so as to melt at a
25 predetermined temperature,
- characterized
- in that the plug (16) is a body which is produced separately from the component (1),
 - in that the plug (16) has a first positive locking
30 contour (18) and can be inserted into the emergency cooling opening (12),
 - in that the first positive locking contour (18), when the plug (16) has been inserted into the emergency cooling opening (12), interacts with a second positive

locking contour (19), which is formed on the component (19) and is of complementary design to the first positive locking contour (18), and connects the plug (16) to the component (1) in a positively locking manner.

14. The plug as claimed in claim 13, characterized by the characterizing features of at least one of claims 1 to 12.

10 15. A component which is acted on by heat in operation, in particular belonging to a turbine,

- the component (1) having a wall (3) which, in operation, is acted on by heat on a first wall side (14) and is acted on by a flow of cooling fluid (11) on a second wall side (15),

15 - the wall (3) having at least one emergency cooling opening (12) which can be closed off by a plug (16) and through which cooling fluid (13) flows from the second wall side (15) to the first wall side (14) when the plug (16) is absent,

20 - the plug (16) being designed so as to melt at a predetermined temperature,

characterized

- in that the component (1) is a body produced separately from the plug (16),

25 - in that the component (1), in the region of the emergency cooling opening (12), has a second positive locking contour (19), which is of complementary design to a first positive locking contour (18) formed on the plug (16),

30 - in that the plug (16) can be inserted into the emergency cooling opening (12),

- in that the second positive locking contour (19), when the plug (16) has been inserted into the emergency

cooling opening (12), interacts with the first positive locking contour (18) and connects the plug (16) to the component (1) in a positively locking manner.

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16. The component as claimed in claim 15, characterized by the characterizing features of at least one of claims 1 to 12.